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grating produces a corresponding shift in the lines of the spectrum.

We may use a Cassegrainian reflector of great relative focal length and a collimator-lens of small linear aperture. However, for average seeing the image would be larger for the instrument of greater focal length, and while we should gain some light, the gain would not be proportionate.

The telescope and spectroscope of greatest efficiency will be those in which the best compromise is made between the various opposing factors; and this will depend to a considerable extent upon the class of work for which the instrument is intended.

Lick Observatory.

VARIABLE STAR NOTES.

By Rose O'Halloran.

V Cassiopeiæ.

When first discovered in December, 1893, by Dr. Anderson, of Edinburgh, *V Cassiopeiæ* was supposed to be a temporary star, but further observation showed that it ranged from about seventh to twelfth magnitude in a period of 229 days. Though in a field thickly strewn with small stars, it may be found without circles by means of two stars of sixth magnitude with which it forms an obtuse triangle. These are numbered 1 and 2 in Flamsteed's catalogue, the variable being about half a degree northeast of the latter, or in R. A. $23^h\ 7^m\ 22^s$, Decl. $+ 59° 8' 4''$. Near the date of predicted maximum, August 15th, it was observed as follows:—

1904.

July 10. Brighter than any of the closely adjacent stars. Equal to *c*.

July 15 and 17. Equal to *d*, less than *b*.

July 30. Brighter than *b*.

July 31. Ditto. Night very clear.

August 1 and 11. Brighter than *a*, which is the brightest of the numerous stars about one third of a degree to the northeast. *V* seems fully of 7.5 magnitude, but is less than star of 6.8 magnitude to the west.

August 29. Less than *a,* brighter than *b.*
September 2. Ditto.
September 6. Less than *b,* equal to *d.*
September 12. Less than *d,* equal to *e.*
September 18. Equal to *e.* Moonlight.

U Cassiopeiæ.

This variable changes from eighth to fifteenth magnitude in 276 days. The following observations, taken during the last two years, accord with intermediate stages of predicted maxima and minima:—

1902.

September 24. Brighter than the faint star about one minute of an arc north of it. In the accompanying chart it is below it and marked *g.*
October 23. Brighter than *e,* less than *d.*
October 28. Equal to *d.*
October 31. Brighter than *d,* less than *c.*
November 3. Ditto.

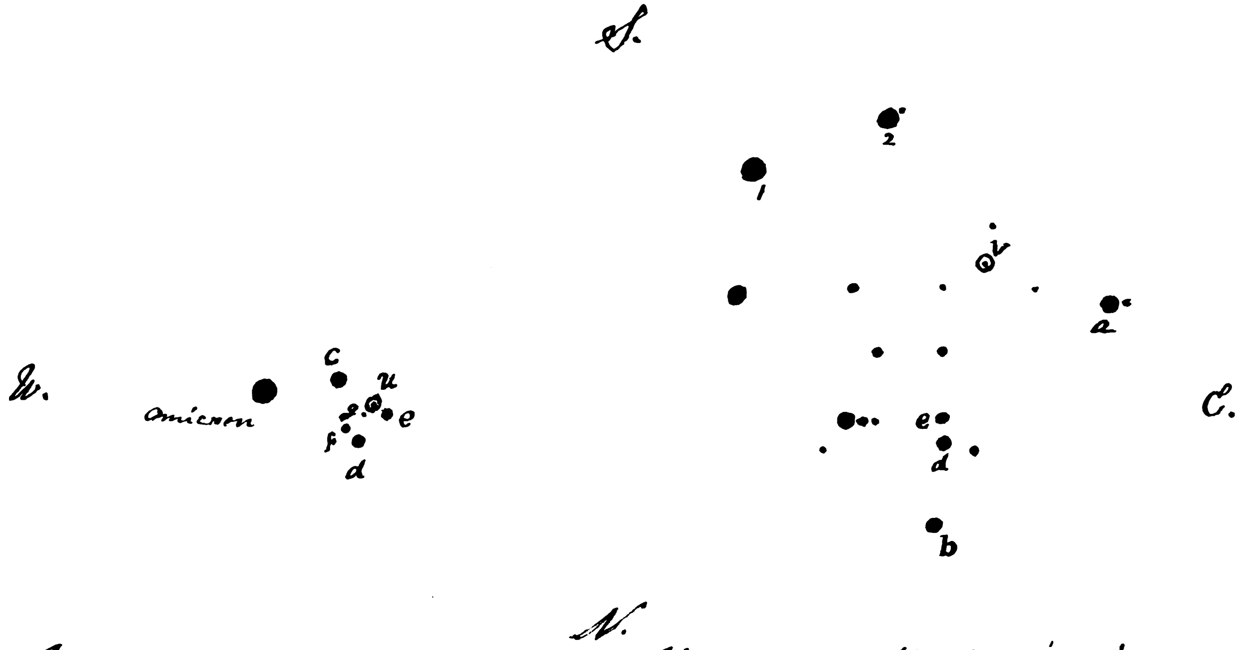
1903.

August 16, 23, and 29. Brighter than *e,* less than *d.*
September 2, 8, 13, and 14. About two-tenths magnitude less than *c.*
September 16. Decreased, but still brighter than *d.*
September 29. Brighter than *e,* less than *a,* equals *d.*
October 12. Dimmer than *e,* brighter than *g.*
October 25. Less than *g.*
November 6. Invisible.

1904.

July 12. Brighter than *d,* less than *c.*
July 15. Ditto.
July 31. Equals *f,* less than *e,* brighter than *g.*
August 1. Less than *f,* brighter than *g.*
August 11. Equals *g.*
September 6, 12, and 18. Invisible.

This variable is in the vicinity of *Omicron* in *Cassiopeia.* In the charts, the comparison stars are named alphabetically, according to magnitude.



Vicinity of U Cassiopeiæ Vicinity of V Cassiopeiæ

W Aurigæ.

Occasional observations of this star were taken as follows: 1904—January 4, 12, and 21, February 5. Invisible.

The maximum was predicted for August 15th, but cloudiness delayed observation until the 20th, when it was invisible, though *k* and *l* of 11 and 11.5 magnitude were distinctly seen. The morning was clear and a high power was used. On September 8th it was also invisible, though *k* was discernible in a hazy atmosphere.

X Aquilæ.

As the minimum of *X Aquilæ* was due on July 21, 1904, its vicinity was observed with a four-inch telescope, in which stars of twelfth magnitude are discernible in very clear weather. Seventeen observations were taken from the 11th of June to the 12th of September, but it was invisible. Several of the evenings were very clear. It may have decreased below twelfth magnitude.

PLANETARY PHENOMENA FOR SEPTEMBER AND OCTOBER, 1904.

BY MALCOLM MCNEILL.

PHASES OF THE MOON, PACIFIC TIME.

Last Quarter,	Sept.	2,	$6^h 58^m$ P.M.	Last Quarter,	Oct.	2,	$5^h 52^m$ A.M.
New Moon,	"	9,	12 43 P.M.	New Moon,	"	8,	9 25 P.M.
First Quarter,	"	16,	7 13 A.M.	First Quarter,	"	15,	9 54 P.M.
Full Moon,	"	24,	9 50 A.M.	Full Moon,	"	24,	2 56 A.M.
				Last Quarter,	"	31,	3 13 P.M.

The autumnal equinox, the time when the Sun crosses the Equator from north to south, occurs September 23d, 4 A.M., Pacific time.

The second of the two eclipses of the year occurred September 9th. It was a total eclipse of the Sun, but it was not visible from any part of the United States. The line of totality ran across the Pacific from a position eastward of the Caroline Islands to the western coast of South America. Unfortunately there are practically no good observing stations along the line as seen on ordinary maps. This is doubly